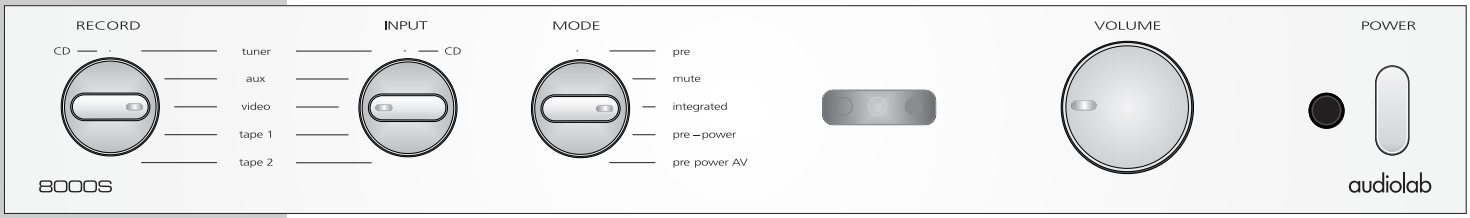
audiolab



service manual

Integrated amplifier 8000S

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1.0 safety and servicing notes

1.1 Safety precautions

1. This unit is Class II, which means that it is not connected to the protective earth system. All live voltages are insulated from the case by double insulation.
2. Do not attempt to service unless qualified to do so.
3. Disconnect unit from AC power supply before removing cover.
4. Components marked with the ⚠ symbol on the circuit schematic are safety critical and must only be replaced with an identical component, or an alternative approved by the manufacturer.
5. Switch unit off, and disconnect from supply before making and breaking any connections.
6. Do not adjust any controls unless instructed to do so in this manual.

1.2 Electrostatic discharge precautions

Electrostatic discharge (ESD) is due to charges produced by insulating materials rubbing together. Humans collect electrostatic charge through normal activities when clothes rub together and when walking on carpet. This charge may be discharged suddenly when you touch a conductor. If the conductor is connected to a sensitive electronic circuit, you may damage the components. It is also possible to reduce the life of components without causing any obvious damage.

To prevent ESD damage, it is necessary to follow these guidelines.

1. Prepare work area. Place an ESD protective mat on the bench, strapped to the protective earth circuit.
2. Prepare yourself. Put on an ESD protective wrist band, strapped to the protective earth circuit, or to the ESD protective mat.
3. Keep all PCBs removed from unit in ESD protective bags.
4. Keep all replacement electronic components, PCBs and stock items in ESD protective bags or boxes.
5. Be particularly careful with components marked with the following symbol:

1.3 Soldering

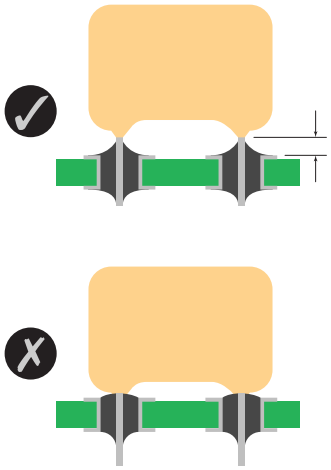
How to de-solder components

Components should be removed, wherever possible, using a de-soldering tool. Be careful not to damage tracks and pads by applying too much pressure.

How to make good solder joints

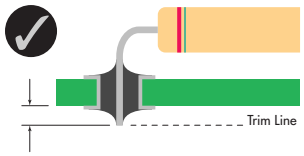
1. Ensure surfaces are clean.
2. Keep soldering iron clean and wetted with solder. Use an appropriate bit. Do not leave soldering iron on when not in use.

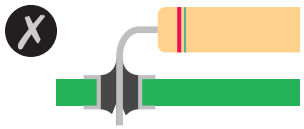
3. Apply soldering iron to both component lead and pad before applying solder. Make sure that the soldering iron is applied long enough for the solder to wet properly, but do not apply for too long or component damage may occur.
4. Allow a small gap between component body and pad. Solder must not reach the base of the component.

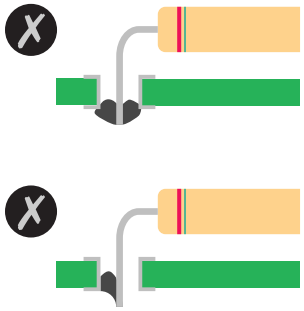


How to detect acceptable joints

1. Solder joints should have from a shiny to satin lustre and a generally smooth appearance.
2. Solder should have wetted both the component lead and pad.
3. There should be a concave meniscus between the objects being soldered. The angle of solder to pad should be less than 90° unless the solder joint extends over the edge of the pad.
4. Solder should fill the component pad and wet component lead around the full circumference (360°).

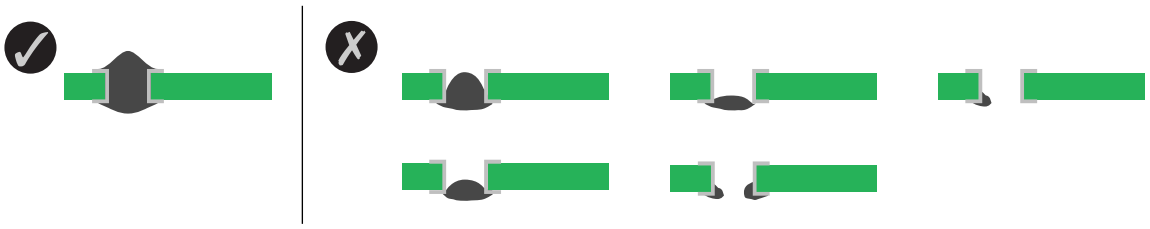






How to detect unacceptable joints

1. Poor wetting produces a bead of solder. The fillet will be convex instead of concave, and there will not be a feather edge.
2. On double-sided PCBs, solder should wet all round plated-through hole, on both sides of the PCB.

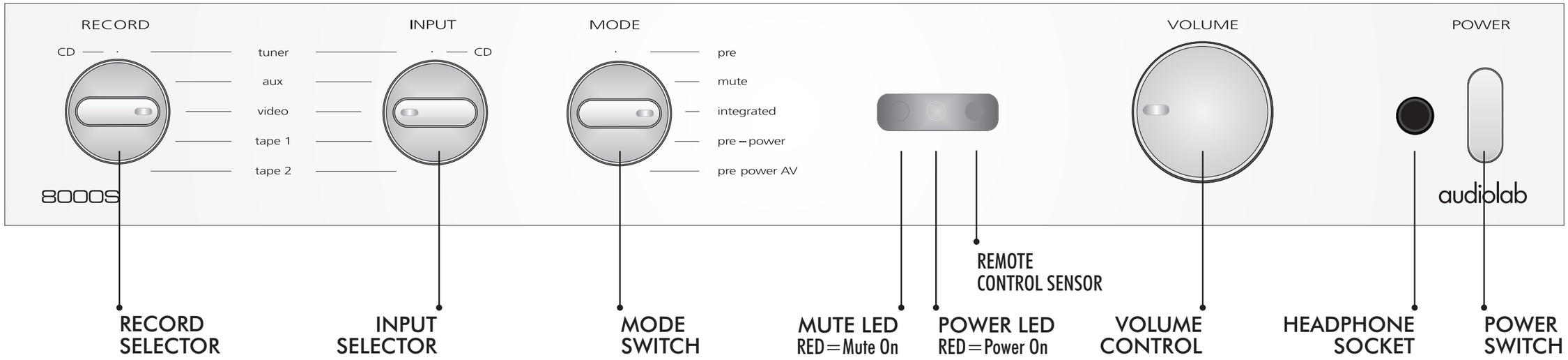


Cleaning up after soldering

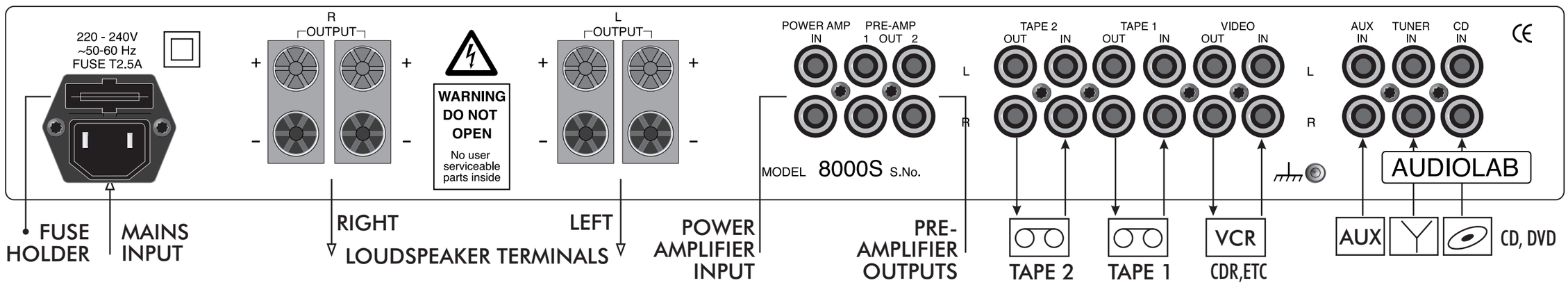
1. Flux is very corrosive. Remove with IPA (propan-2-ol) before completing the job.
2. Remove any solder balls and splashes from the unit.
3. Check all new solder joints and ensure all PCBs are clean before replacing covers.
4. After replacing covers, clean the case and any display windows with a damp cloth. Do not use any organic solvents. If scratched, replace display windows.

2.0 front and rear panel layouts

2.1 Front panel controls



2.2 Rear panel connections



4.0 functional tests

These notes are provided to assist you in servicing the amplifier. The circuit schematics are marked with typical voltage levels, which may assist in defining the cause of any problem.

4.1 Test equipment required

Equipment	Specification
Digital Multimeter	Accuracy better than 0.5% in V and mV ranges
Dual Tracking DC Power Supply	Output: ±32 V DC 2 A *Positive terminal of negative supply must be connected to negative terminal of the positive supply unless internally linked*
Various Leads	

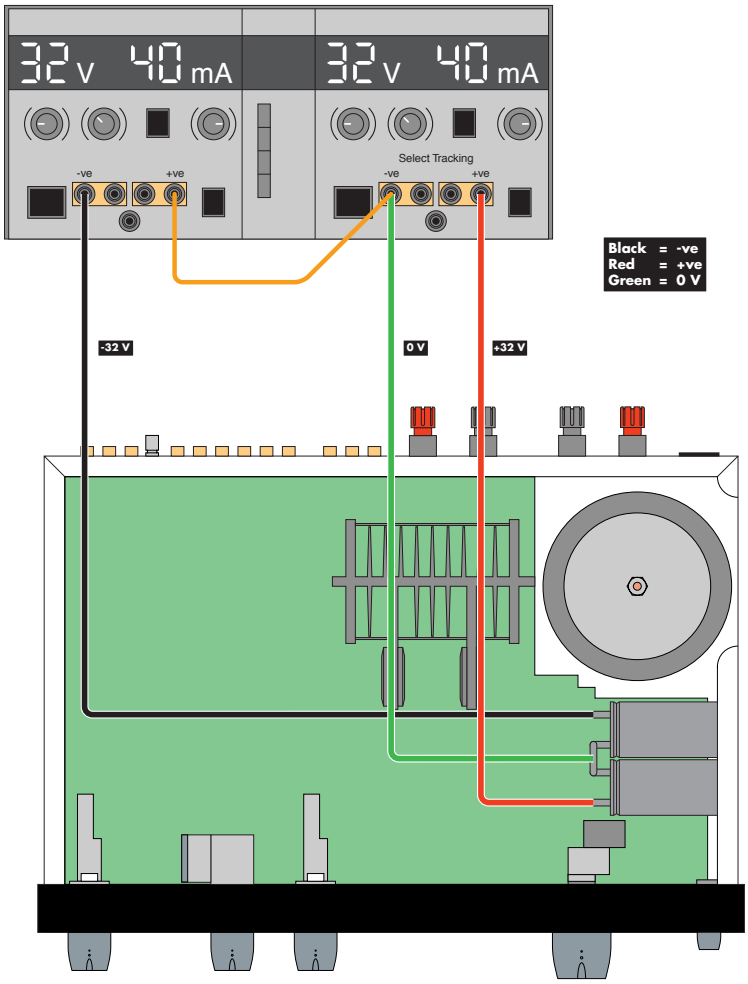


Figure 4.1 - Functional test set-up

4.2 Functional test procedure

For test point (TP) references, see section 6.0 Test Points.

No	Action	Test Equipment	Details
4.2.1.	Disconnect all cables from amplifier		
4.2.2.	Check voltage setting		Read ratings label on rear of amplifier.
4.2.3.	Check fuse type		Open fuse holder in power socket on rear panel. Rated supply Fuse Type 230 V AC T2.5A L250V 115 V AC T4A 125V 110 V AC T4A 125V
4.2.4.	Check fuse resistance	Multimeter set to Ω	Fuse and spare fuse should be low resistance.
4.2.5.	Set up power supply	Dual tracking DC power supply	Set output voltage to ±32 V, current limited to 500 mA.
4.2.6.	Remove cover		
4.2.7.	Connect supplies as shown in Figure 4.1	Dual tracking DC power supply	With supplies off, connect • positive output of supply to positive terminal of reservoir capacitor • negative output of supply to negative terminal of capacitor No connection is required to 0 V terminal of power supply. **CAUTION:** Do not connect with wrong polarity.
4.2.8.	Apply DC voltage to amplifier	Dual tracking DC power supply	Check supply outputs are ±32 V and switch output on. Current output should be <300 mA negative supply and <600 mA positive supply. If higher, turn RV701 (TP 24) and RV801 (TP 25) fully anti-clockwise. Continue with test procedure of current output is 180 mA ±25 mA negative supply and 515 mA ±25 mA positive supply. If higher, switch off and investigate.
4.2.9.	Measure left channel supply rails	Multimeter set to V DC	Measure voltage across D713 (TP 1+ and TP 1-) and D714 (TP 2+ and TP 2-). Voltage should be 32 V ±0.25 V.

4.2 Functional test procedure

For test point (TP) references, see section 6.0 Test Points.

No	Action	Test Equipment	Details
4.2.10.	Measure right channel supply rails	Multimeter set to V DC	Measure voltage across D813 (TP 3+ and TP 3-) and D814 (TP 4+ and TP 4-). Volatge should be 32 V ±0.25 V.
4.2.11.	Check preamplifier supply rails	Multimeter set to V DC	Connect negative probe to 0 V (TP 0). Connect positive probe to 30 V test point (TP 19). Voltage should be 28 V ±3 V. Connect positive probe to 10 V test point (TP 15). Voltage should be 10 V ±0.3 V. Connect positive probe to 5 V test point (TP 16). Voltage should be 5 V ±0.3 V.
4.2.12.	Left channel Check power amplifier	Multimeter set to V DC	Measure voltage across R731 (TP 5+ and TP 5-). Voltage should be 0.85 V ±0.1 V. Measure voltage across R735 (TP 6+ and TP 6-). Voltage should be 0.85 V ±0.1 V.
4.2.13.	Left channel Measure amplifier offset	Multimeter set to mV DC	Connect negative probe to 0 V (TP 0). Connect positive probe to R749 (TP 9). Voltage should be <5 mV.
4.2.14.	Left channel Measure preamplifier	Multimeter set to V DC	Connect positive probe to R518 (TP 12). Voltage should be 14 V ±1 V.
4.2.15.	Right channel Check power amplifier	Multimeter set to V DC	Measure voltage across R831 (TP 7+ and TP 7-). Voltage should be 0.85 V ±0.1 V. Measure voltage across R835 (TP 8+ and TP 8-). Voltage should be 0.85 V ±0.1 V.
4.2.16.	Right channel Measure amplifier offset	Multimeter set to mV DC	Connect negative probe to 0 V (TP 0). Connect positive probe to R849 (TP 10). Voltage should be <5 mV.
4.2.17.	Right channel Measure preamplifier	Multimeter set to V DC	Connect positive probe to R618 (TP 13). Voltage should be 14 V ±1 V.

4.2 Functional test procedure

For test point (TP) references, see section 6.0 Test Points.

No	Action	Test Equipment	Details
4.2.18.	Measure offset of protection circuit	Multimeter set to mV DC	Connect positive probe to cathode of D943 (TP 11). Voltage should be <5 mV.
4.2.19.	Disconnect DC power supplies		
4.2.20.	Fix any faults		If any faults have been detected, repair and return to the beginning of this test procedure.
4.2.21.	Connect amplifier to AC power input		
4.2.22.	Measure left channel supply rails	Multimeter set to V DC	Measure volatge across D713 (TP 1+ and TP 1-) and D714 (TP 2+ and TP 2-). Volatge should be 44 V ± 2.5 V.
4.2.23.	Measure right channel supply rails	Multimeter set to V DC	Measure volatge across D813 (TP 3+ and TP 3-) and D814 (TP 4+ and TP 4-). Volatge should be 44 V ± 2.5 V.
4.2.24.	Check operation of mute relay	Multimeter set to V DC	Connect negative probe to 0 V (TP 0). Connect positive probe to cathode of D951 (TP 23). Switch on AC power button. Voltage should increase slowly from 0 to 12 V then relay should operate and voltage should increase to 41 V ±2 V.
4.2.25.	Check preamplifier supply rails	Multimeter set to V DC	Connect negative probe to 0 V (TP 0). Connect positive probe to 30 V test point (TP 19). Voltage should be 28 V ±3 V. Connect positive probe to 10 V test point (TP 15). Voltage should be 10 V ±0.5 V. Connect positive probe to 5 V test point (TP 16). Voltage should be 5 V ±0.3 V.
4.2.26.	Left channel Check power amplifier	Multimeter set to V DC	Measure voltage across R731 (TP 5+ and TP 5-). Voltage should be 0.85 V ±0.1 V. Measure voltage across R735 (TP 6+ and TP 6-). Voltage should be 0.85 V ±0.1 V.

4.2 Functional test procedure

For test point (TP) references, see section 6.0 Test Points.

No	Action	Test Equipment	Details
4.2.27.	Left channel Measure amplifier offset	Multimeter set to mV DC	Connect negative probe to 0 V (TP 0). Connect positive probe to R749 (TP 9). Voltage should be <5 mV.
4.2.28.	Left channel Measure preamplifier	Multimeter set to V DC	Connect positive probe to R518 (TP 12). Voltage should be 14 V ±1 V.
4.2.29.	Right channel Check power amplifier	Multimeter set to V DC	Measure voltage across R831 (TP 7+ and TP 7-) Voltage should be 0.85 V ±0.1 V. Measure voltage across R835 (TP 8+ and TP 8-) Voltage should be 0.85 V ±0.1 V.
4.2.30.	Right channel Measure amplifier offset	Multimeter set to V DC	Connect negative probe to 0 V (TP 0). Connect positive probe to R849 (TP 10). Voltage should be <5 mV.
4.2.31.	Right channel Measure preamplifier	Multimeter set to V DC	Connect positive probe to R618 (TP 13). Voltage should be 14 V ±1 V.
4.2.32.	Measure offset of protection circuit	Multimeter set to mV DC	Connect positive probe to cathode of D943 (TP 11). Voltage should be <5 mV.
4.2.33.	Fix any faults		If any faults have been detected, repair and return to the beginning of this test procedure .
4.2.34.	Allow amplifier to warm up		Leave on for 20 minutes with cover on. It is not necessary to screw cover down.
4.2.35.	Left channel Check bias	Multimeter set to V DC	Connect probes across legs of R748 (TP 1- and TP 2-). Voltage should be 22 mV ±0.5 mV. If necessary, adjust RV701 (TP 24).
4.2.36.	Right channel Check bias	Multimeter set to V DC	Connect multimeter probes across legs of R848 (TP 3- and TP 4-). Voltage should be 22 mV ±0.5 mV. If necessary, adjust RV801 (TP 25).
4.2.37.	Readjust bias		Leave on for a further 10 minutes. Repeat 4.2.35 and 4.2.36.

5.1. Test equipment required

Equipment	Specification
True RMS multimeter	Accuracy better than 0.5% in V and mV ranges
Audio analyser	Able to measure • distortion to 0.001% with 200Hz high pass filter • signal to noise ratio greater than 95 dB with IHF A-weighted filter
Oscilloscope	20 MHz, dual channel
Output loads	8 Ω (125 W) and short circuit
Shorted phono plugs	2 off
Various leads	

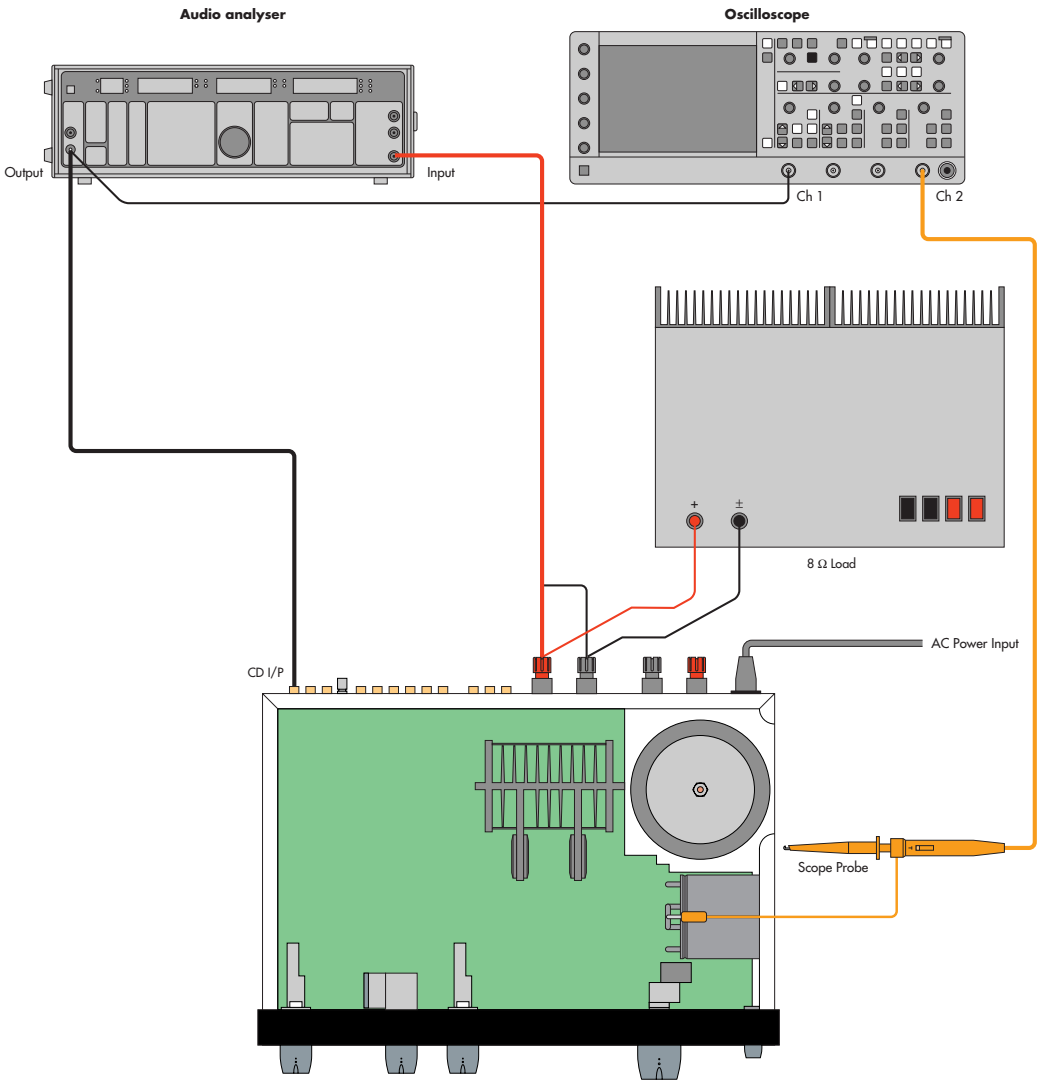


Figure 5.1 Performance test set-up. Connections for left channel shown, repeat connections for right channel.

5.2 Performance test procedure

For test point (TP) references, see section 6.0 Test Points.

No	Action	Test Equipment	Details
5.2.1.	Switch off AC power button		
5.2.2.	Connect amplifier as shown in Figure 5.1	Audio Analyser output connected to both left and right CD inputs 8 Ω load	Output frequency: 1 kHz sine wave Output voltage: 100 mV rms Reading settings: AC level, Auto, 200 Hz HP filter on A-weighted filter off
5.2.3.	Switch on AC power button		Select **cd** using **INPUT** selector knob. Select **pre** using **MODE** selector knob.
5.2.4.	Adjust volume knob to maximum		
5.2.5.	Measure output of preamplifier	Audio Analyser output: 1kHz, 100 mV rms Multimeter set to mV AC	Measure output of left and right **PRE AMP** sockets. Voltage should be 286 mV rms ±10 mV rms.
5.2.6.	Measure output of power amplifier	Audio Analyser output: 1kHz, 100 mV rms 200Hz HP filter on A-weighted filter off	Select **integrated** using **MODE** selector knob. Measure output of left and right loudspeaker terminals. Voltage should be 8 V rms ±0.2 V rms.
5.2.7.	Reduce **VOLUME** knob to minimum		
5.2.8.	Set **OUTPUT** to 20 V rms	Audio Analyser output: 1kHz, 1 V rms 200Hz HP filter on A-weighted filter off	Increase volume until amplifier **OUTPUT** is 20 V rms. If signal is increased further, amplifier will begin to clip.
5.2.9.	Measure distortion at 1 kHz	Audio Analyser output 1kHz, 1 V rms 200Hz HP filter on A-weighted filter off	Distortion of left and right channels should be <0.006%

5.2 Performance test procedure

For test point (TP) references, see section 6.0 Test Points.

No	Action	Test Equipment	Details
5.2.10.	Set up amplifier for 1 W output	Audio Analyser output: 1kHz, 500 mV	Adjust **VOLUME** knob until voltage on output of amplifier is 2.83 V rms (or 1 W). If possible, set this as 0 dB reference.
5.2.11.	Measure signal to noise ratio (SNR)	Audio Analyser 200Hz HP filter off A-weighted filter on	Remove input leads and replace with shorted phono plugs. Measure dB reading (if function is available), which is equivalent to signal-to-noise ratio. Alternatively measure noise voltage and calculate SNR. SNR should be >80 dB. $SNR = 10 \log_{10} \frac{\text{signal power}}{\text{noise power}}$ $SNR = 20 \log_{10} \frac{\text{signal voltage}}{\text{noise voltage}}$
5.2.12.	Measure distortion at 20 kHz	Audio Analyser output: 20kHz, 1 V, 200Hz HP filter on A-weighted filter off	Adjust the **VOLUME** knob to give 20 V rms at loudspeaker output. Distortion should be <0.07% for left and right channels.
5.2.13.	Measure distortion at 100 Hz	Audio Analyser output: 100Hz, 1V 200Hz filter off A-weighted filter off	Distortion should be <0.007% for left and right channels.
5.2.14.	Left channel check operation of protection circuit	Audio Analyser output: 1 kHz, 100 mV Oscilloscope ch1: 0.5 V/div 0.2 Vms/div ch2: 0.2 V/div 0.2 ms/div trigger: ch1	Turn **VOLUME** knob to minimum. Connect ground clip of oscilloscope probe to 0 V (TP 0). Connect probe for channel 2 to cathode of D943 (TP 11). Short circuit loudspeaker terminal. Slowly increase **VOLUME**. Check oscilloscope traces with Figure 5.2. Trace will appear briefly and will disappear when amplifier mutes.

5.2 Performance test procedure

For test point (TP) references, see section 6.0 Test Points.

No	Action	Test Equipment	Details
5.2.15.	Right channel check operation of protection circuit	Audio Analyser output voltage: 100 mV Output frequency: 1 kHz Oscilloscope ch1: 0.5 V/div 0.2 ms/div ch2: 0.2 V/div 0.2 ms/div trigger: ch1	Turn **VOLUME** knob to minimum. Leave probe on cathode of D943 (TP11). Short circuit loudspeaker terminal. Slowly increase **VOLUME**. Check oscilloscope traces with Figure 5.2. Trace will appear briefly and will disappear when amplifier mutes.
5.2.16.	Left channel check mute operation	Multimeter set to diode test ⊣▶⊢	Disconnect input signal and loudspeaker leads. Turn **VOLUME** knob to 12 o'clock. Connect negative probe to 0 V (TP 0). Connect positive probe to input socket signal pin (TP 21). Make sure amplifier mutes. Disconnect positive probe. Make sure mute relay resets (not muted). Relay will click.
5.2.17.	Left channel check mute operation reverse polarity	Multimeter set to diode test ⊣▶⊢	Connect positive probe to 0 V (TP 0). Connect negative probe to input socket signal pin (TP 21). Make sure amplifier mutes. Disconnect positive probe. Make sure mute relay resets (not muted). Relay will click.
5.2.18.	Right channel check mute operation	Multimeter set to diode test ⊣▶⊢	Connect negative probe to 0 V (TP 0). Connect positive probe to input socket signal pin (TP 22). Make sure amplifier mutes. Disconnect positive probe. Make sure mute relay resets (not muted). Relay will click.

5.2 Performance test procedure

For test point (TP) references, see section 6.0 Test Points.

No	Action	Test Equipment	Details
5.2.19.	Right channel check mute operation reverse polarity	Multimeter set to diode test →|	Connect positive probe to 0 V (TP 0). Connect negative probe to input socket signal pin (TP 22). Make sure amplifier mutes. Disconnect positive probe. Make sure mute relay resets (not muted). Relay will click.
5.2.20.	Reassemble unit		Remove all leads
5.2.21.	Noise check	Connect to CD player and preamplifier and play a TAG McLaren Audio Test Tracks CD	Reconnect loudspeaker connections and listen to audio output for good audio performance.
5.2.22.	Check operation of remote controller		Check remote funtions: volume input selection muting
5.2.23.	Clean with damp cloth		

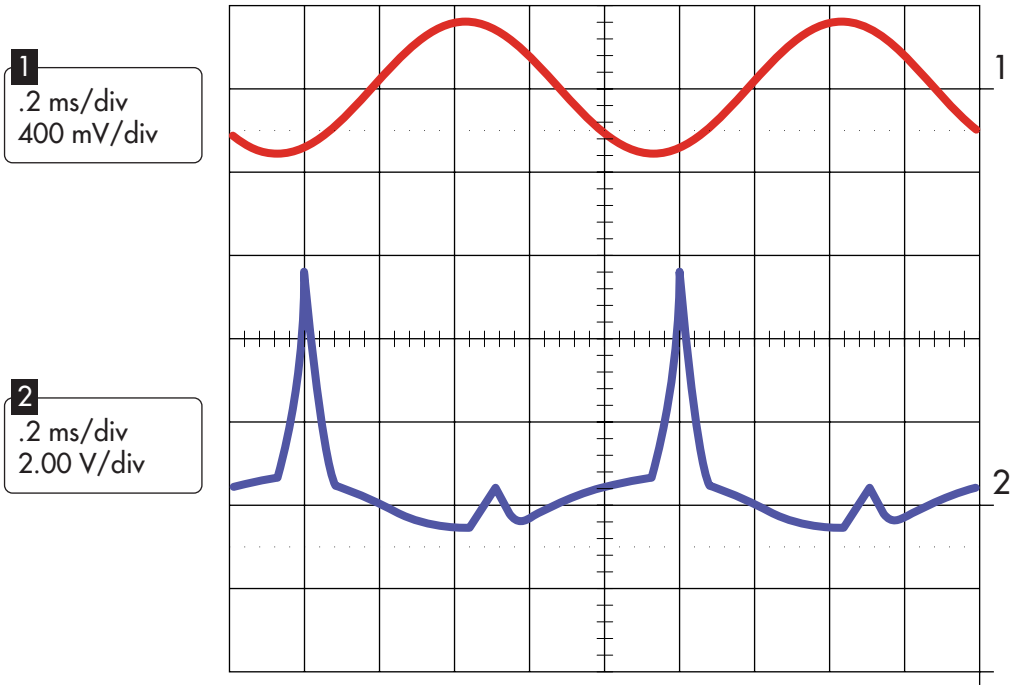
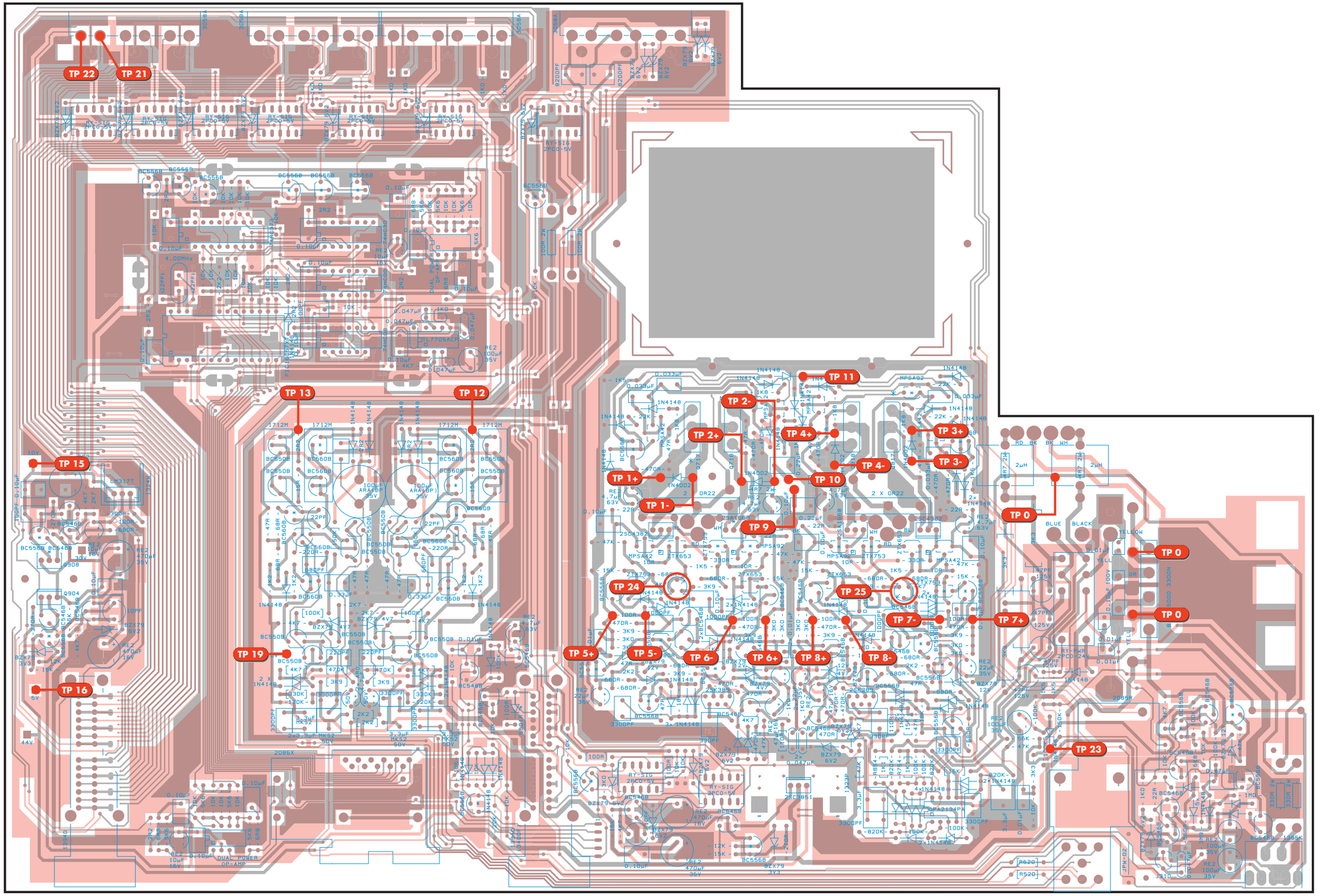
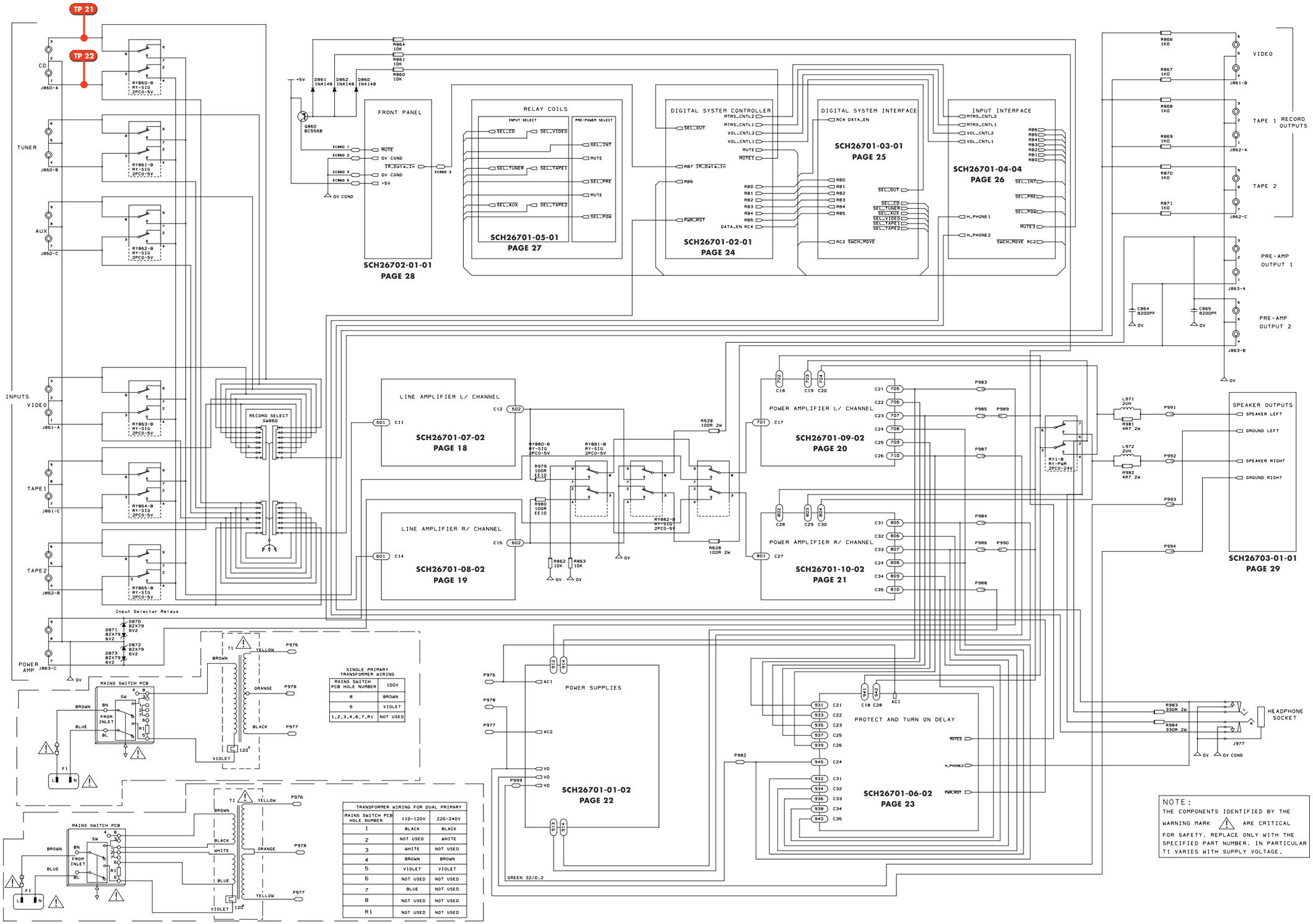


Figure 5.2 Protection circuit waveforms

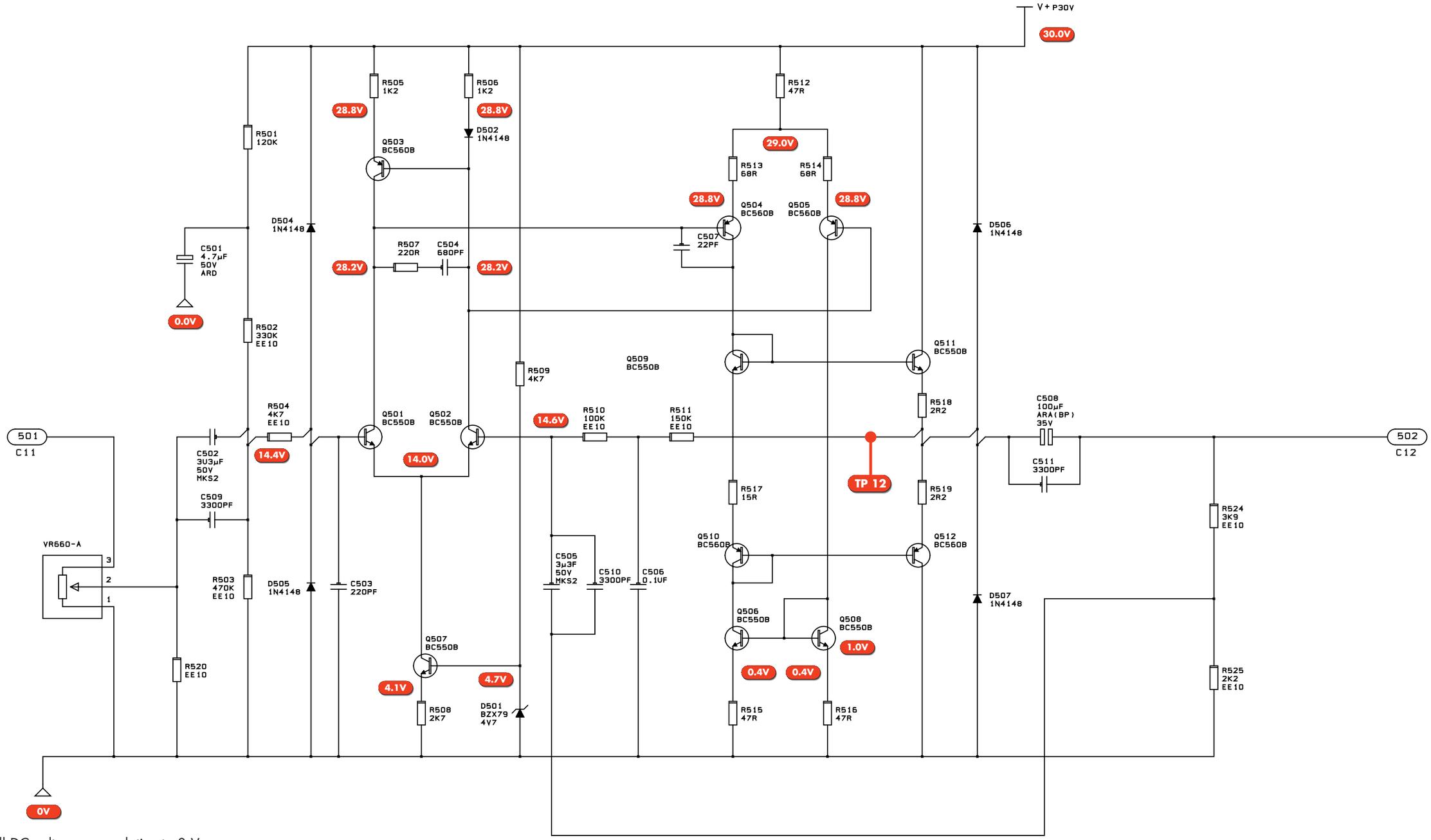
6.1 Functional and performance test points



7.1.1 Master schematic diagram (SCH267M-01-05)

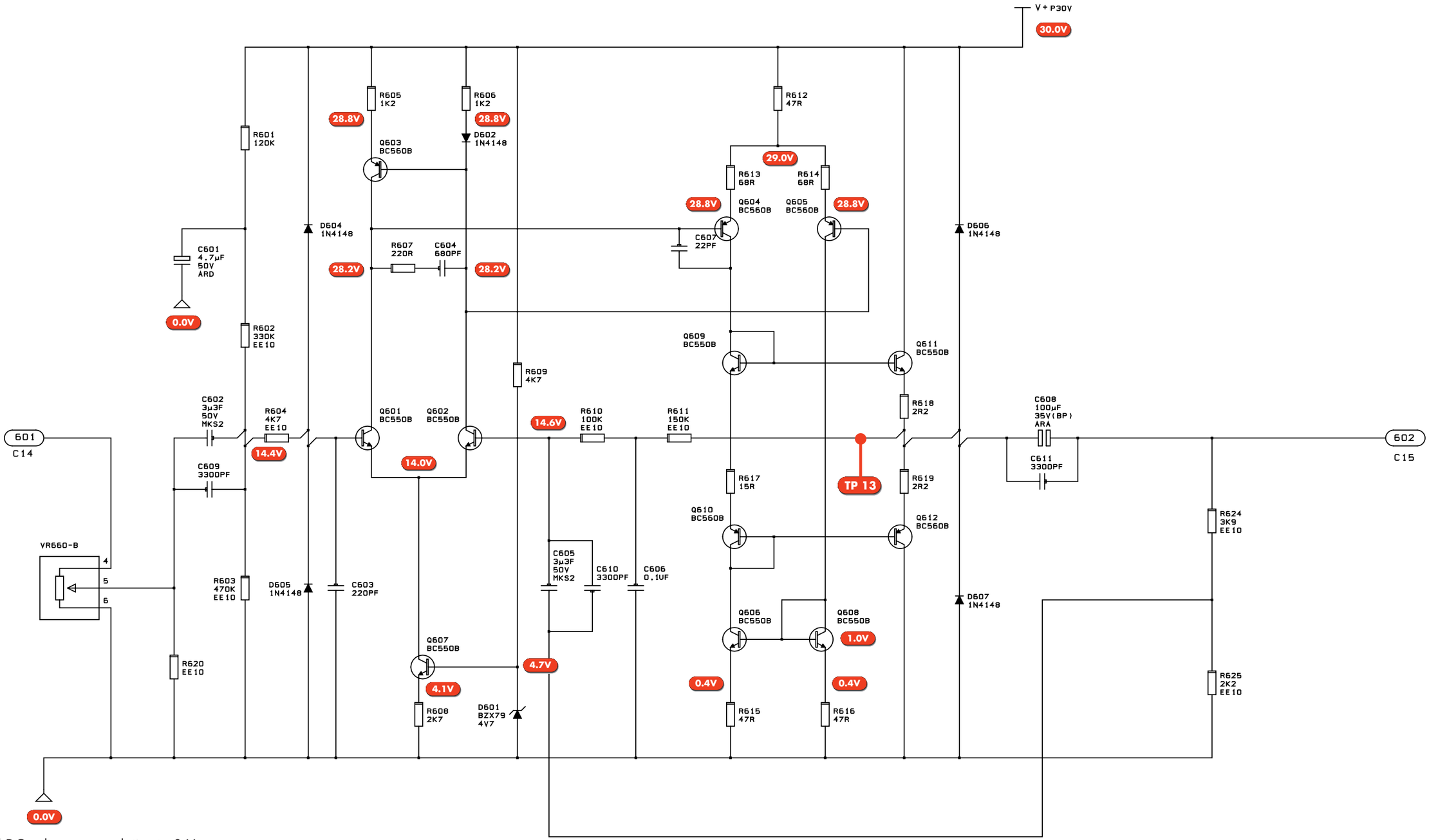


7.2.1 Line amplifier left channel schematic (SCH26701-07-02)



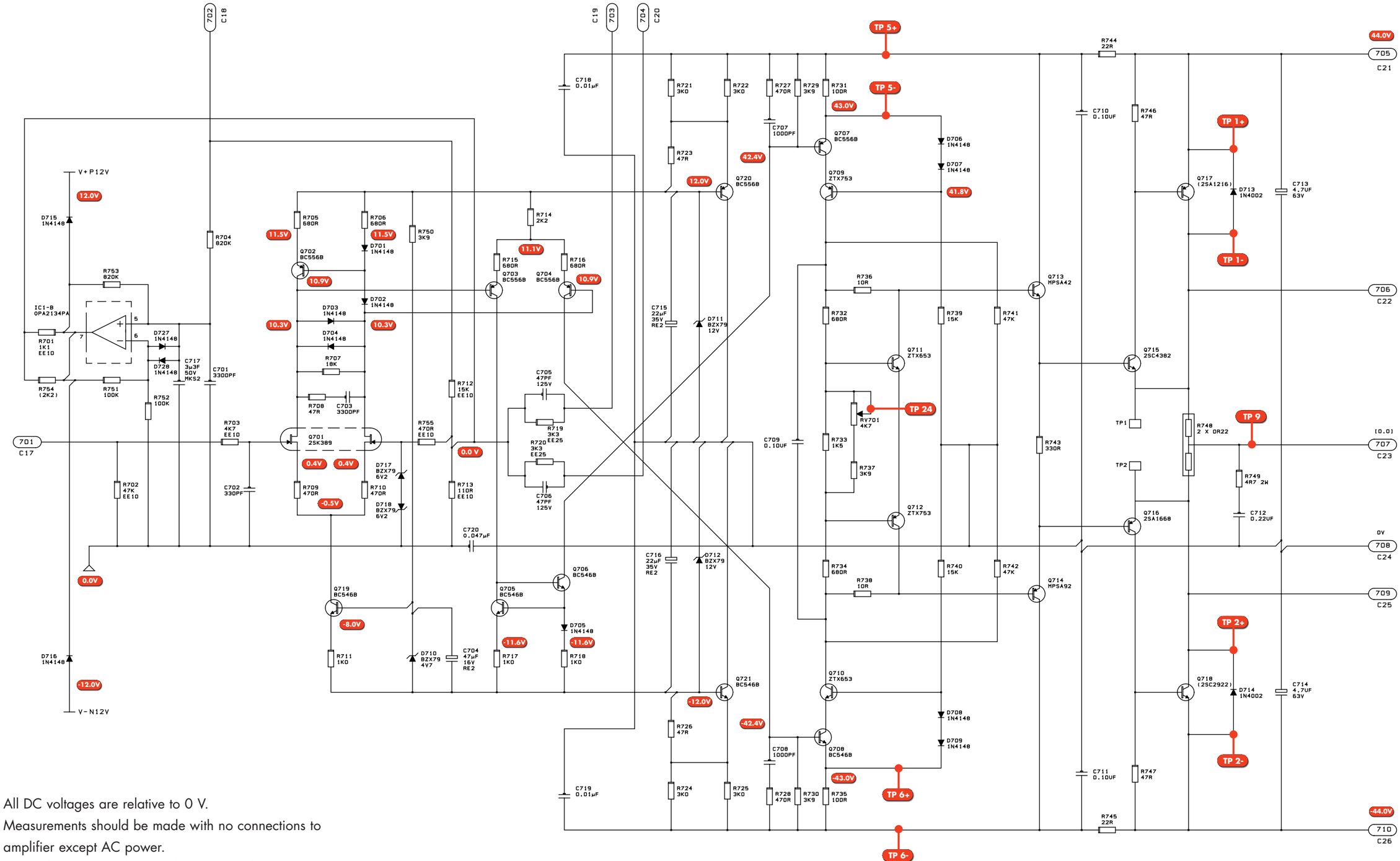
All DC voltages are relative to 0 V.
Measurements should be made with no connections to amplifier except AC power.
Use high input impedance voltmeter (>20 kΩ/V).
Meter must be “floating” relative to ground.

7.3.1 Line amplifier right channel schematic (SCH26701-08-02)



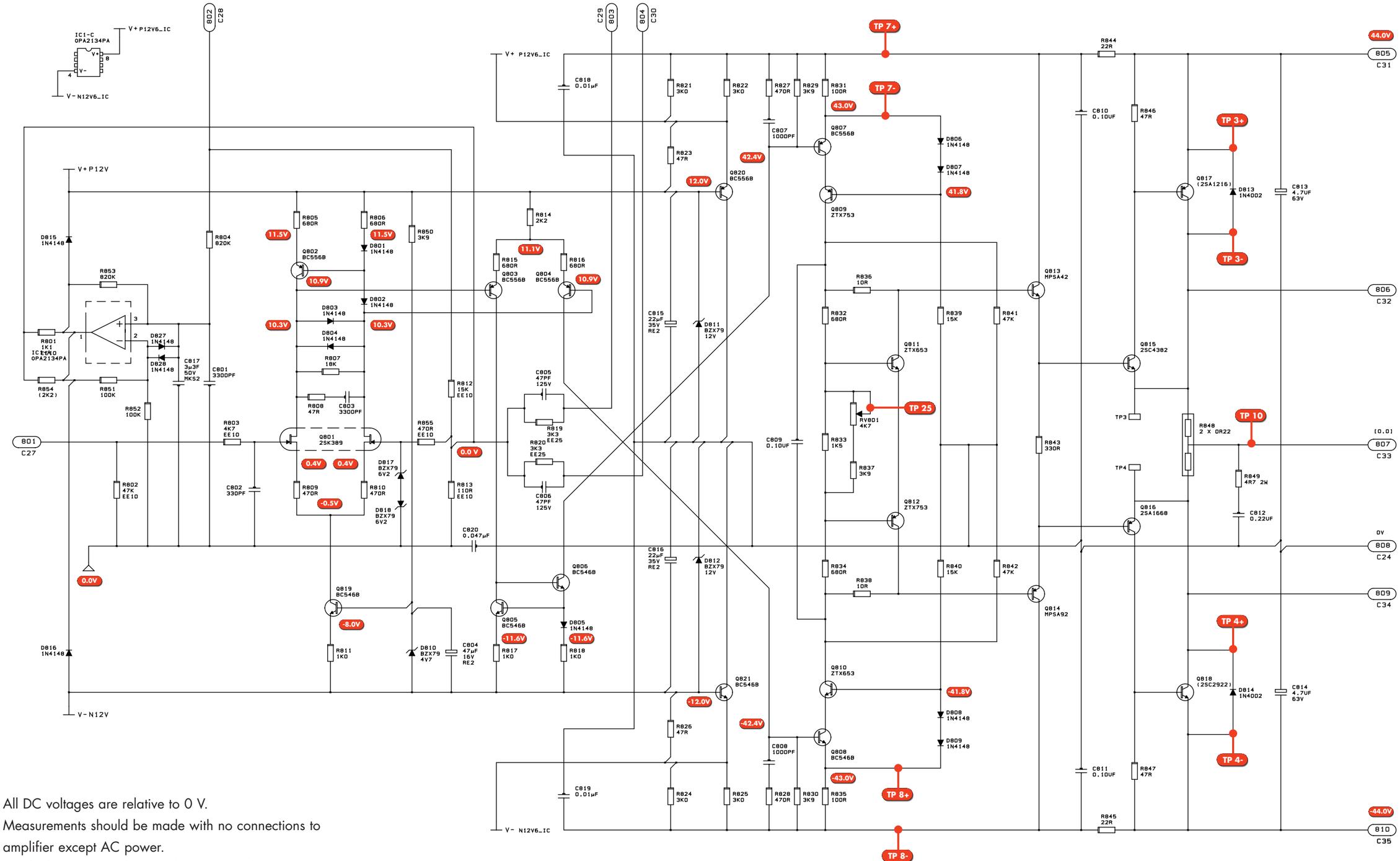
All DC voltages are relative to 0 V.
Measurements should be made with no connections to amplifier except AC power.
Use high input impedance voltmeter (>20 kΩ/V).
Meter must be “floating” relative to ground.

7.4.1 Power amplifier left channel schematic (SCH26701-09-02)



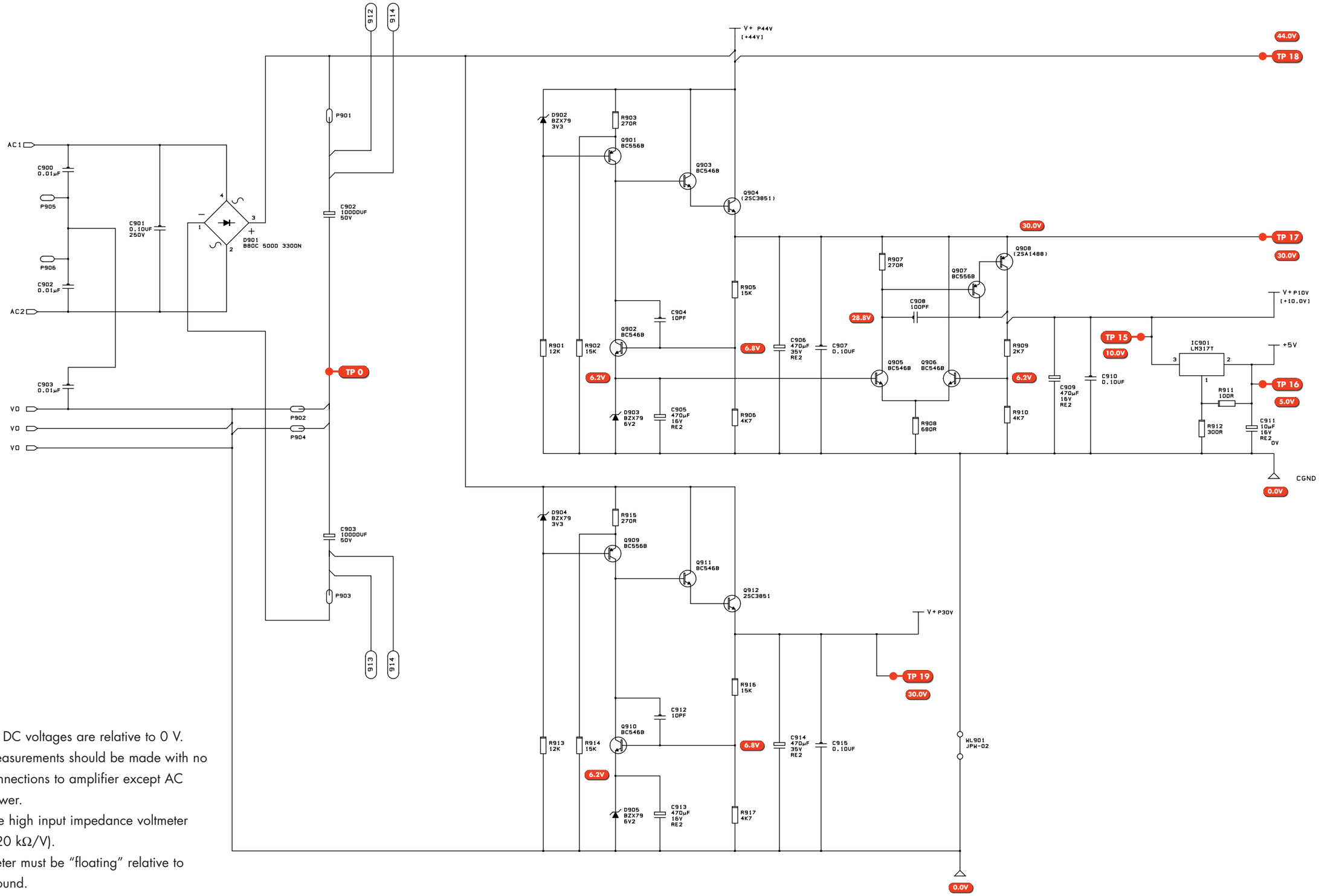
All DC voltages are relative to 0 V.
Measurements should be made with no connections to amplifier except AC power.
Use high input impedance voltmeter (>20 kΩ/V).
Meter must be “floating” relative to ground.

7.5.1 Power amplifier right channel schematic (SCH26701-10-02)



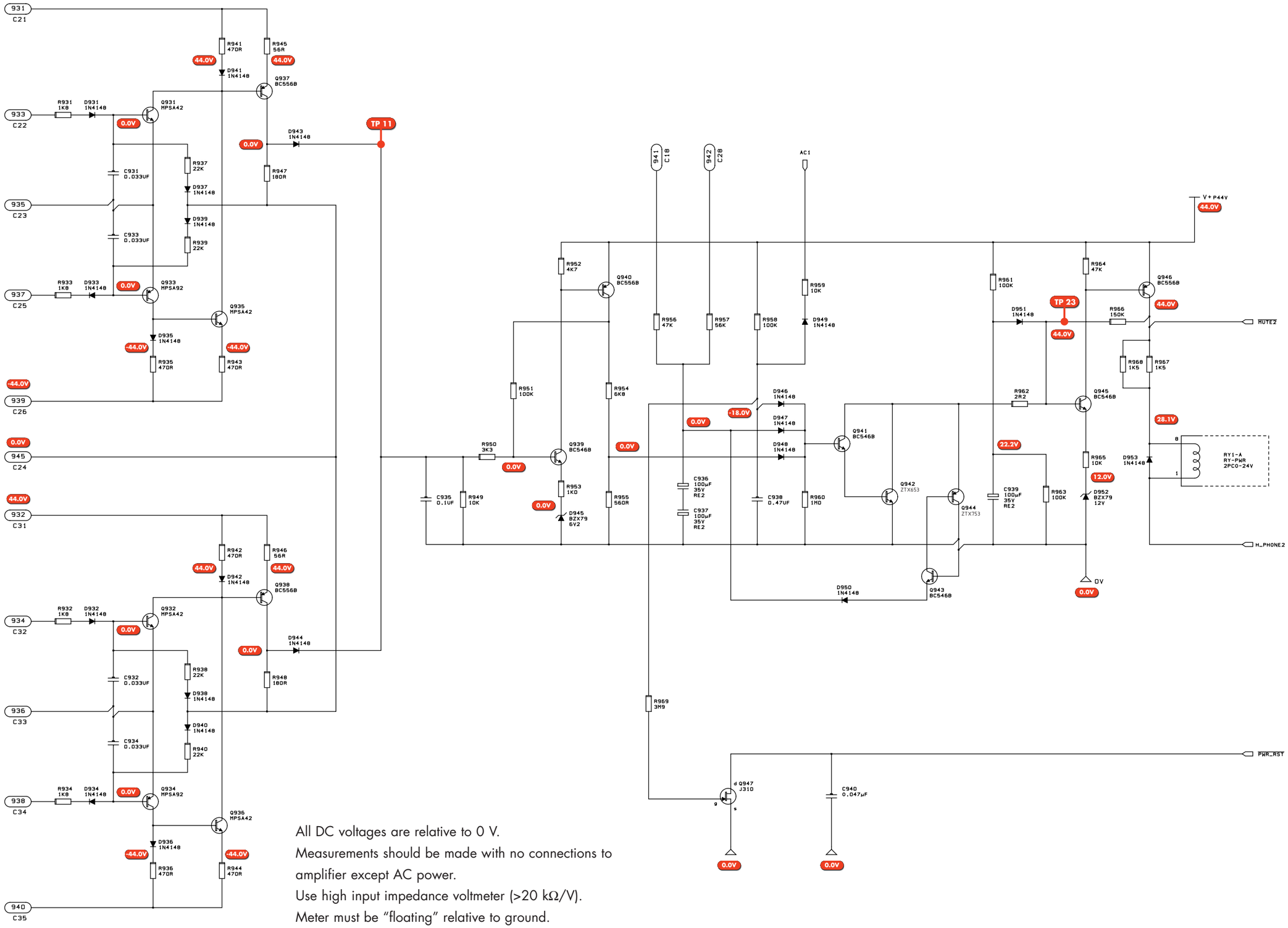
All DC voltages are relative to 0 V.
Measurements should be made with no connections to amplifier except AC power.
Use high input impedance voltmeter (>20 kΩ/V).
Meter must be “floating” relative to ground.

7.6.1 Power supplies schematic (SCH26701-01-02)



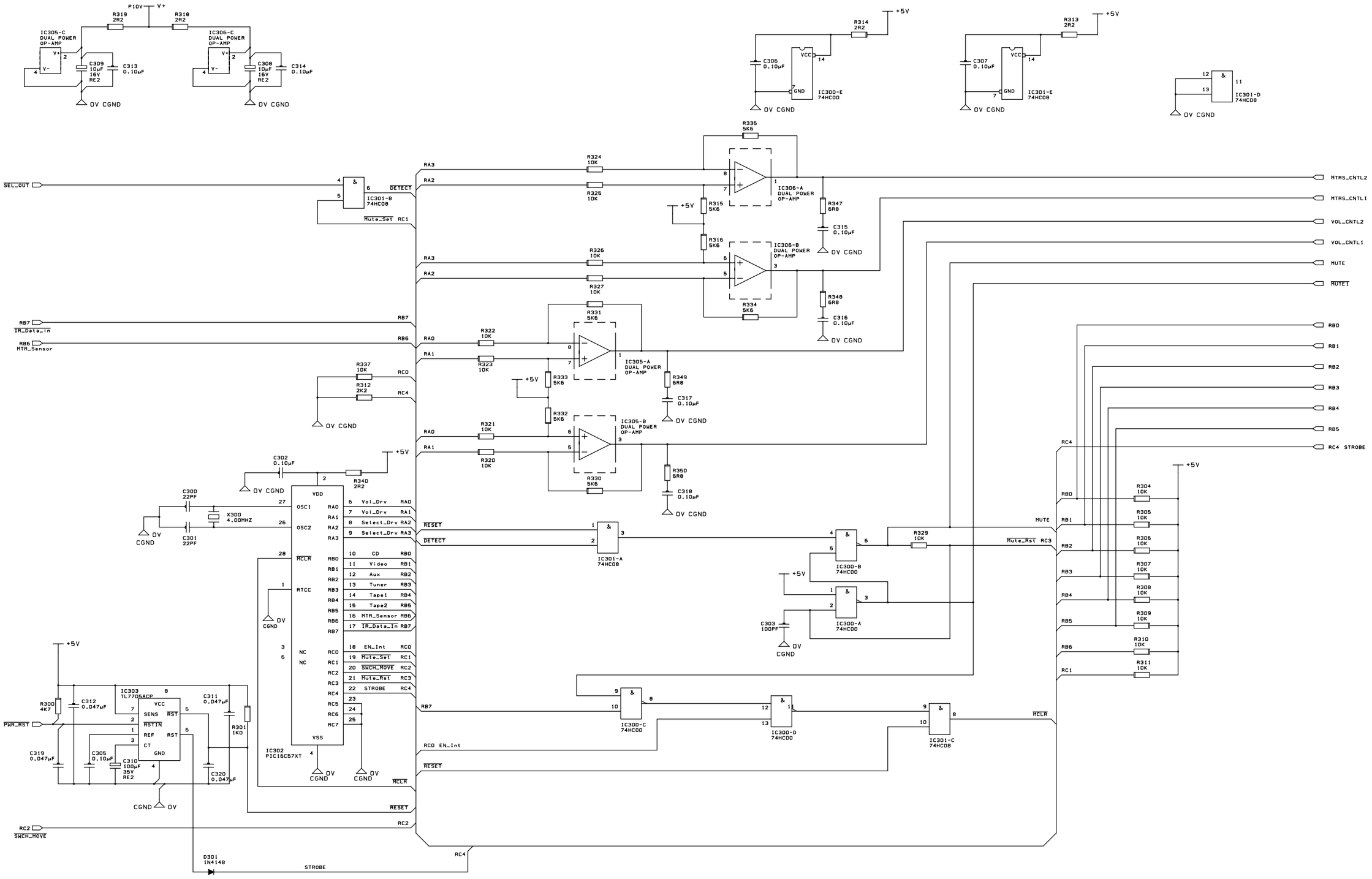
All DC voltages are relative to 0 V.
Measurements should be made with no connections to amplifier except AC power.
Use high input impedance voltmeter (>20 kΩ/V).
Meter must be “floating” relative to ground.

7.7.1 Protect and turn on schematic (SCH26701-06-02)

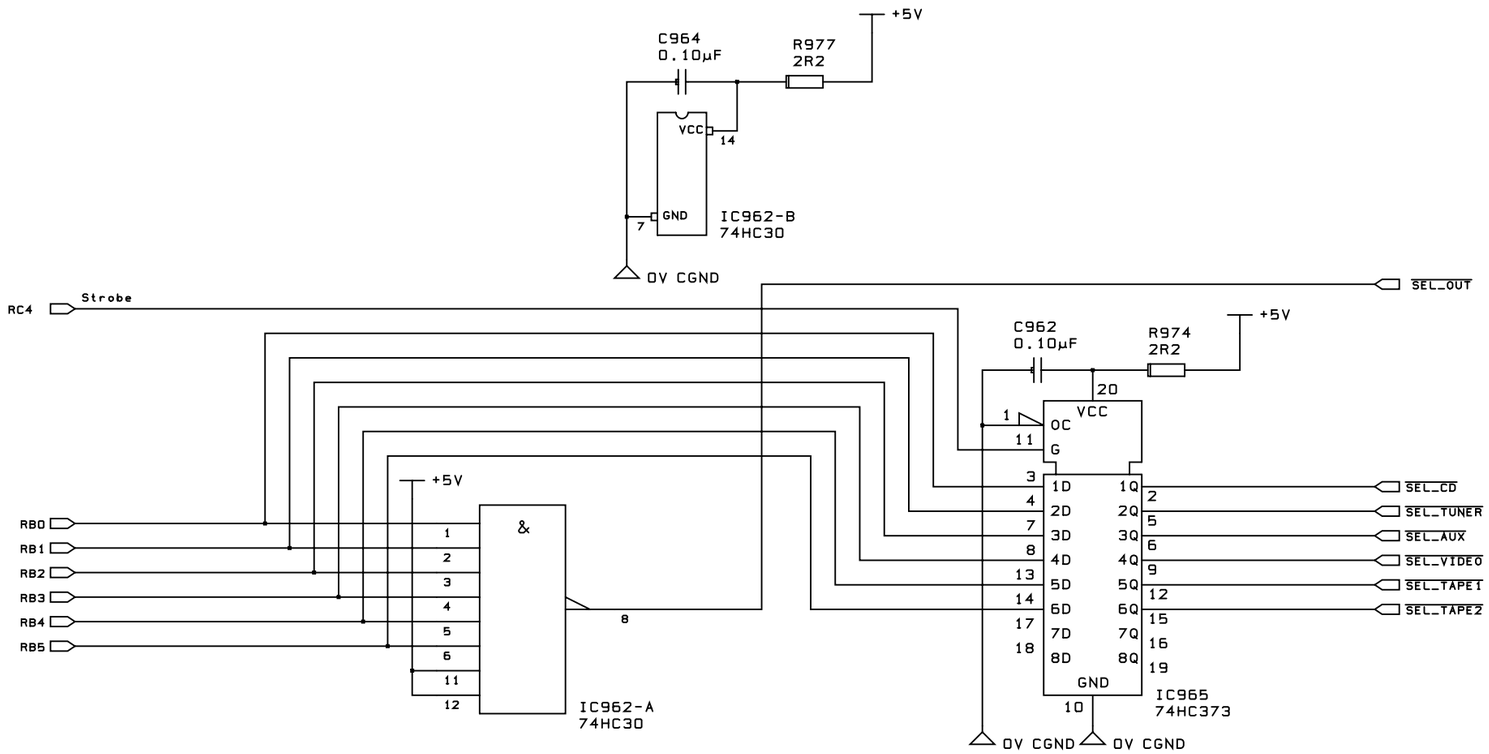


All DC voltages are relative to 0 V.
Measurements should be made with no connections to amplifier except AC power.
Use high input impedance voltmeter (>20 kΩ/V).
Meter must be "floating" relative to ground.

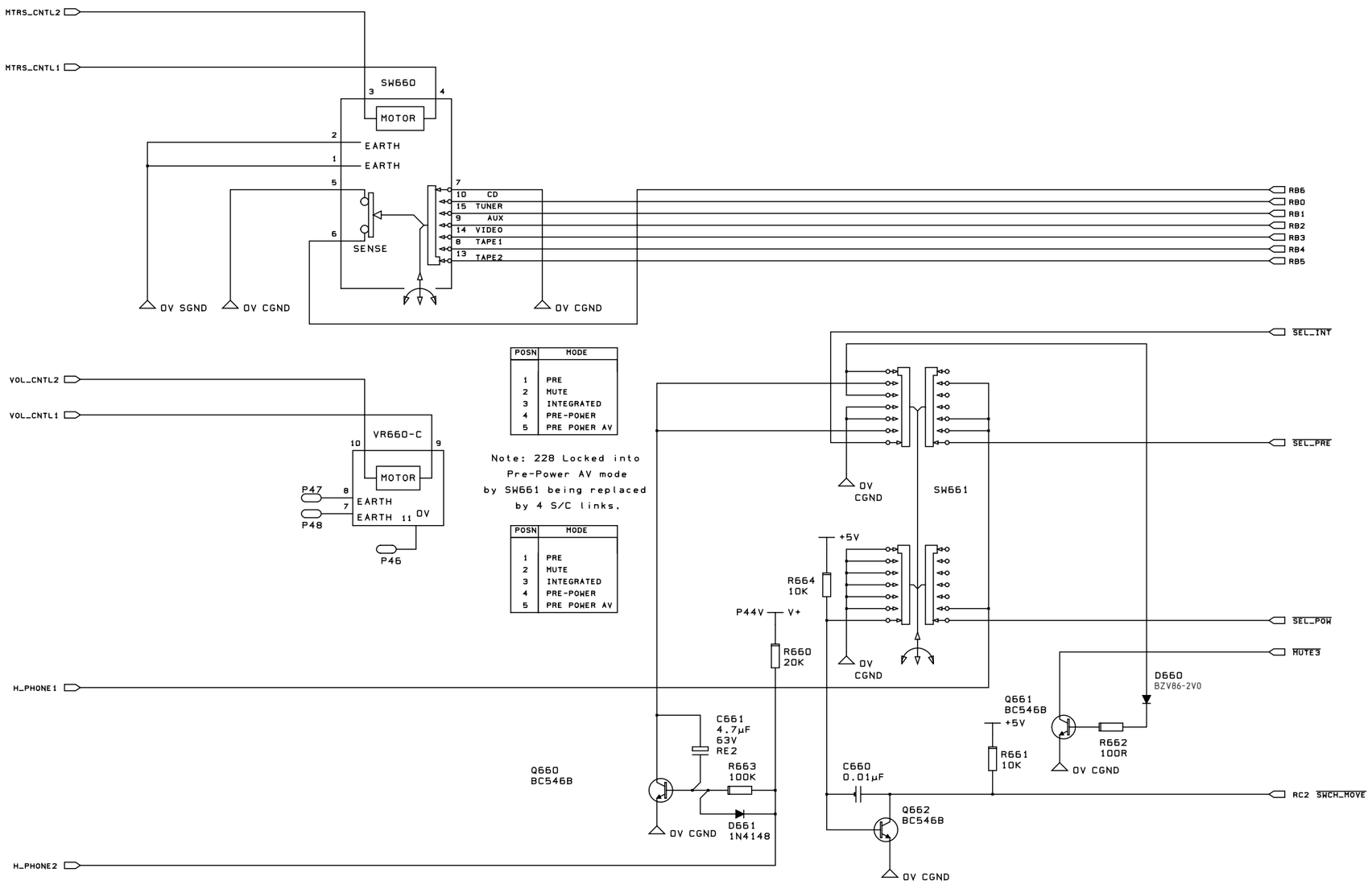
7.8 Digital system controller schematic (SCH26701-02-01)



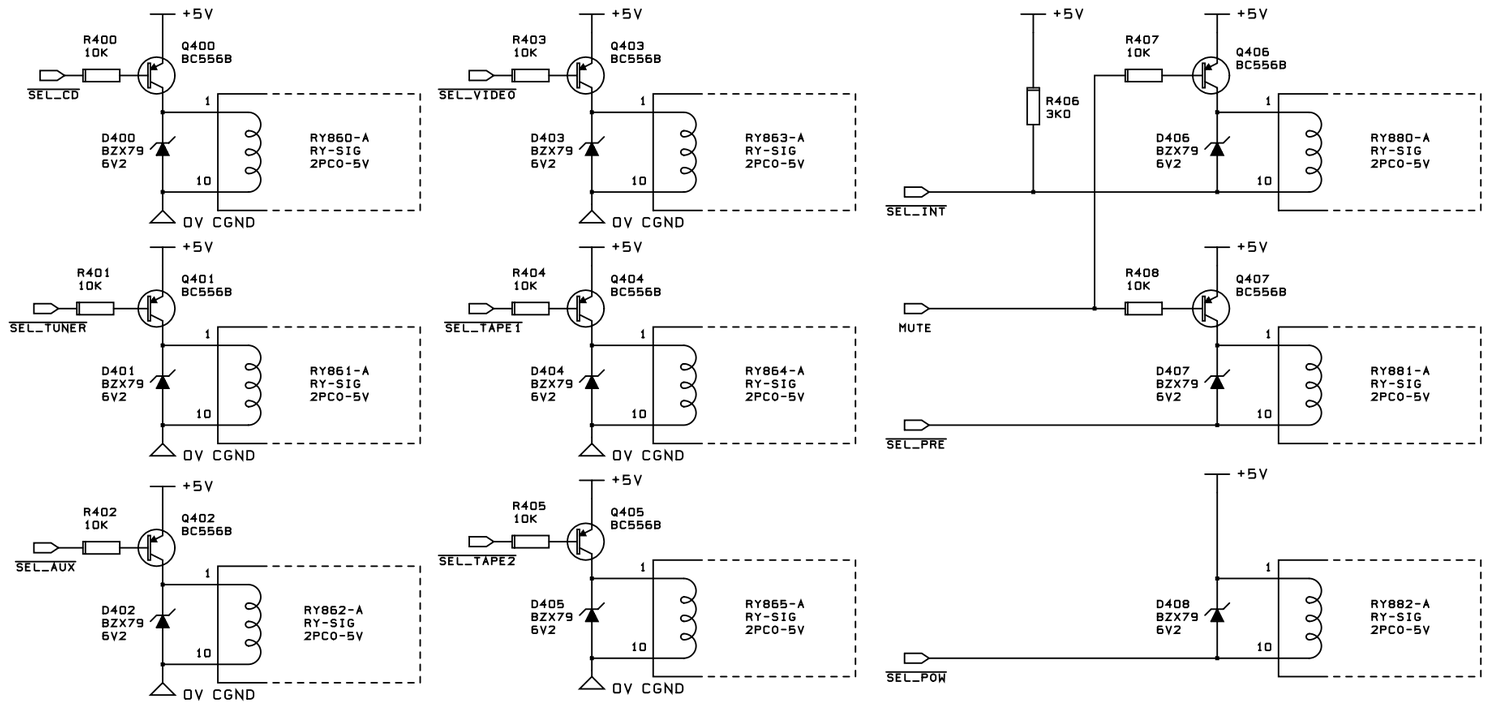
7.9 Digital system interface schematic (SCH26701-03-01)



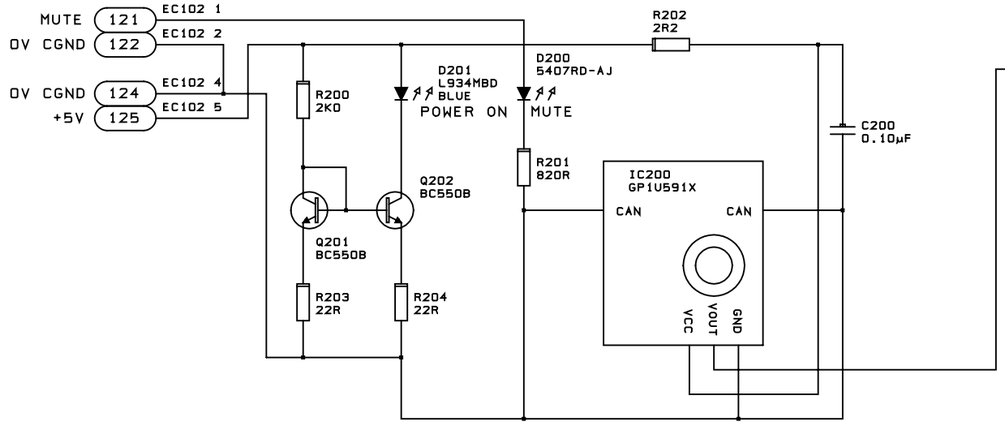
7.10.1 Input interface schematic (SCH26701-04-04)

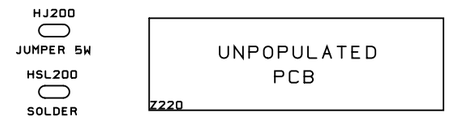


7.11 Relay coils schematic (SCH26701-05-01)

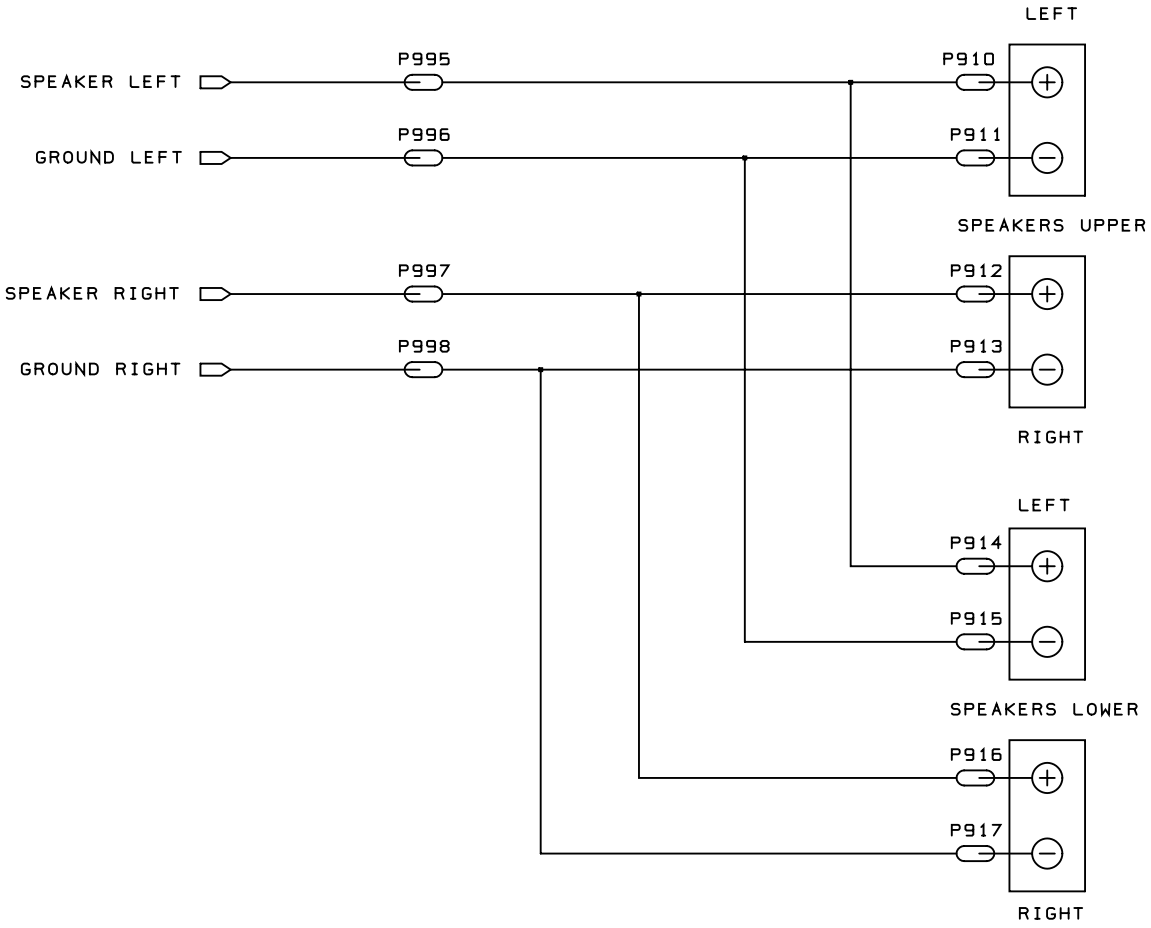


7.12 Front panel schematic (SCH26702-01-01)

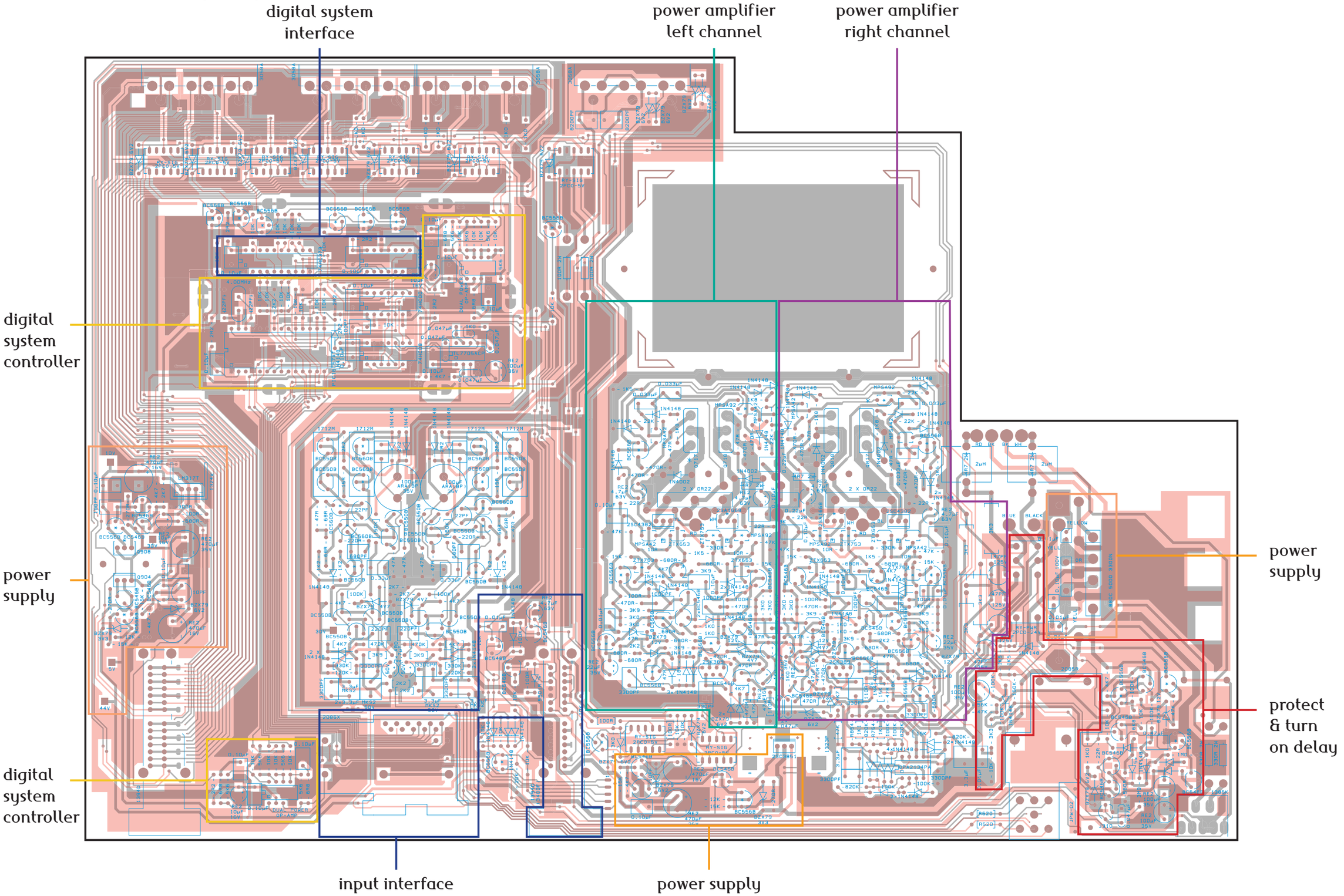




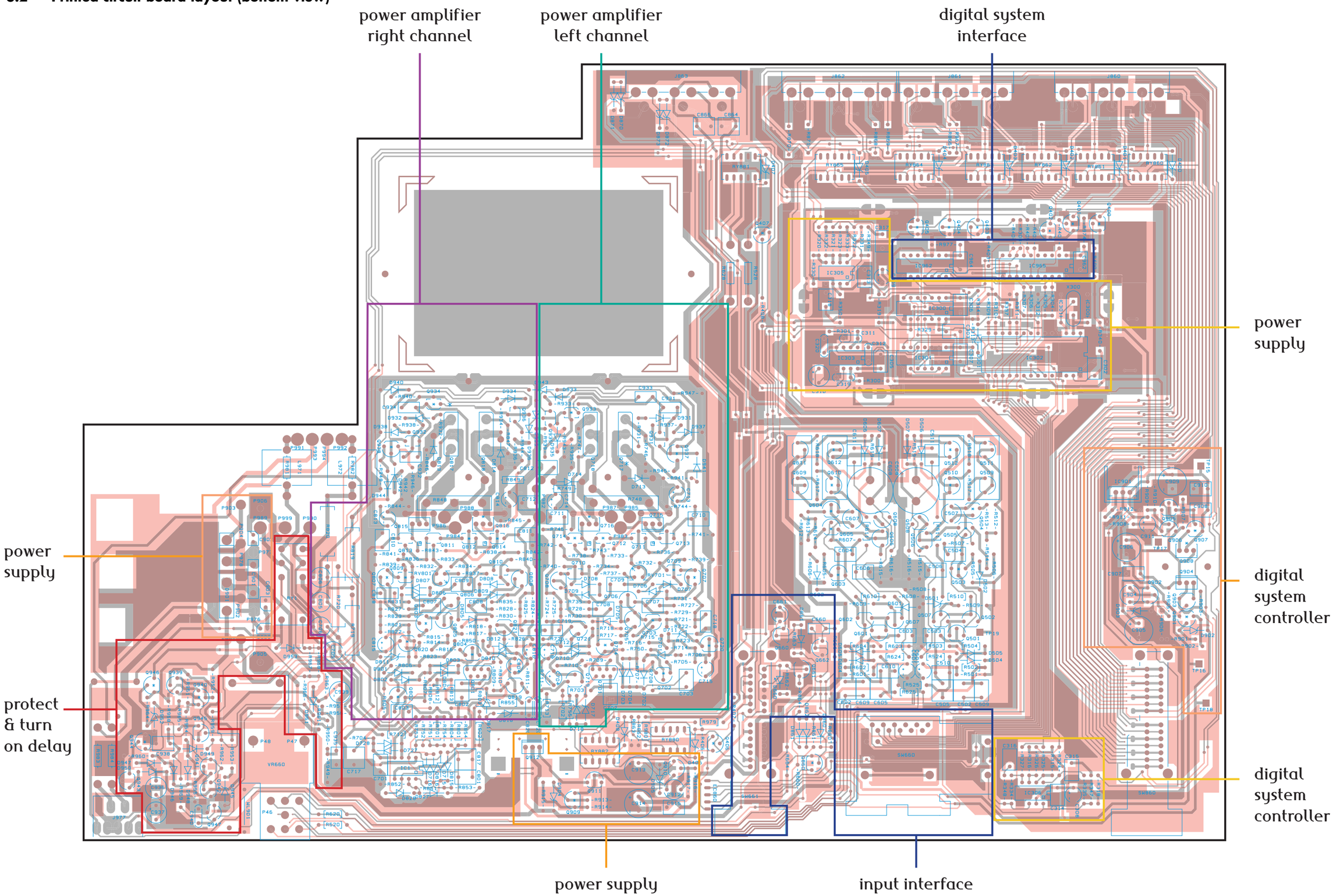
7.13 Speaker outputs schematic (SCH26703-01-01)



8.1 Printed circuit board layout (top view)



8.2 Printed circuit board layout (bottom view)



9.1 8000S Technical specifications

(both channels driven)	60 W per channel into rated load impedance (8 Ω) 95 W into 4 Ω and 130 W into 2 Ω for short periods
(both channels driven)	72 W per channel into rated load impedance (8 Ω) 115 W into 4 Ω and 150 W into 2 Ω for short periods
	20 kΩ nominal
	175 mV rms (relative to 0.5 V rms preamplifier output)
	9 dB at 1 kHz
	greater than 80 dB (relative to 0.5 V rms preamplifier output)
	100 Ω nominal
	greater than 7.76 V rms
	1 kΩ nominal
	0 dB (i.e. the record output level is the same as the input level)
	47 kΩ nominal
	782 mV rms (for full rated output)
	29.0 dB at 1 kHz
	greater than 80 dB (relative to 0 dBW)
(-3dB)	1 Hz – 65 kHz

9.1 8000S Technical specifications

(20 Hz – 20 kHz)	± 0.5 dB
	less than 0.07%
	greater than 60 dB at 1 kHz
	greater than 80 dB at 1 kHz
(phase)	non-inverting for all inputs and outputs
	330 Ω (suitable for headphones of 8 Ω – 2 kΩ impedance)
	10 – 35 °C
	50 – 60 Hz
	110 – 120 V or 220 – 240 V The voltage is marked on the rear of the unit
	less than 300 W
(including feet, terminals and controls)	445 mm wide 75 mm high 350 mm deep

The rated and typical performance applies when the mains supply voltage is either 230 V AC for 220 - 240 V units or 115 V AC for 110 - 120 V units

We reserve the right to alter design and specification without notice
Specification may vary for different countries

9.2 International standards

The 8000S meets or exceeds all the legal requirements listed below:

89/336/EEC	EMC Directive (as amended by 93/23/EEC)
* 73/23/EEC	Low Voltage Directive (as amended by 93/23/EEC)

* IEC65:	1985
* IEC65 A2:	1989
* IEC65 A3:	1992
* EN60065:	1993

EN50081 -1:	1992
EN55022 Class B:	1994
EN60555 -2:	1987
EN61000 -3-2:	1995
EN61000 -3-3:	1995
FCC Part 15 Class B:	1997

EN50082 -1:	1992
IEC801 -2:	1991 ± 8 kV air discharge
IEC801 -3:	1984 3 V/m
IEC801 -4:	1988 ± 1 kV AC power, ± 500 V other ports
EN61000 -4-2:	1995 ± 8 kV air, ± 4 kV contact discharge
EN61000 -4-4:	1995 ± 1 kV AC power, ± 500 V other ports
EN61000 -4-5:	1995 ± 2 kV common mode, ± 1 kV differential mode
EN61000 -4-11:	1994

* 115 V units are fitted with 4 mm terminals. They comply with 73/23/EEC, IEC65 and EN60065 in all other aspects

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